

Amendments to the Drawings

The attached drawing sheets include changes to Figs. 1, 2 and 5. These sheets, which include Figs. 1, 2 and 5, replace the original sheets including Figs. 1, 2 and 5. In Fig. 1, typographical errors have been corrected in blocks 104, 106 and 108. In Fig. 2, typographical errors have been corrected in blocks 124, 128, 134, 136 and 138, and step 139 has been added. In Fig. 5, reference numerals have been added in accordance with the original disclosure.

Attachment: Replacement Sheets (3)

REMARKS

Applicants respectfully traverse and request reconsideration.

Various typographical errors have been corrected by amendment in the originally-filed abstract, disclosure and figures. Fig. 2 has further been amended to add step 139. Similarly, typographical errors have been corrected by amendment to claims 1, 4-5, 8-9, 11, 14-16, 18-19. Claims 1 and 8 have been amended such that the method requires the worklist to be in memory. Claims 1, 9, 14, and 19 have also been amended to replace the term “if” with the term “when.” Claims 10 and 17 have been cancelled without prejudice. Claims 21-24 have been added.

Drawing Objections

Fig. 5 stands objected to for not containing all corresponding labels that are described in originally-filed written description. Appropriate correction has been made by amendment. Applicants respectfully request that the objection be withdrawn.

Specification Objections

The specification stands objected to in view of an alleged informality in paragraph 0038. Applicants have amended the written description to correct this alleged informality/typographical error.

Claim Objections

Claims 8 and 14 stand object to in view of an alleged informality. Applicants have amended the aforementioned claims to correct this alleged informality/typographical error.

Claim Rejections

Section 101

Claims 8-13 stand rejected under 35 U.S.C. § 101 because the claims are allegedly directed to non-statutory subject matter. The Office action states claim 8 “recites ‘receiving;

adding ... [] generating ...,' lines 2-8. There is no final tangible result produced from this claim (see MPEP 2106 (IV)(C)(2))." (Office action, p. 3). Although Applicants disagree, language indicating that the worklist is in memory has been added to the claim to advance prosecution.

Applicants further disagree with the Office action's position that a claim must provide a final result that is useful, tangible and concrete in order to comply with 35 U.S.C. § 101. Applicants respectfully submit that looking at the last step of any claim is not the proper basis for rejecting the claim under section 101 but to the contrary, the claimed subject matter must be reviewed "as a whole". In any event, however, Applicants note that the final element of claim 8 is:

generating a worklist in memory by:
for each of the plurality of instructions, determining if the
instruction is a critical instruction; and
if the instruction is a critical instruction, writing the
instruction to the worklist in memory.

That is, the final element of the claim requires "generating a worklist in memory by" Accordingly, Applicants respectfully submit that the currently amended claim 8 meets the requirements set forth in the current Office action. For at least this reason, claim 8 is believed to constitute statutory subject matter.

Claims 9 and 11-13 each depend upon claim 8. Claim 10 has been cancelled. Accordingly, each of claims 9 and 11-13 also have at least one concrete, useful and tangible result. Applicants remind the Examiner that a claim must be "considered as a whole to determine whether it is for a particular application of an abstract idea, natural phenomenon, or law of nature, and not for the abstract idea, natural phenomenon, or law of nature itself." MPEP 2106 (IV)(C) (emphasis added). Further, the Interim Guidelines of Examination of Patent Applications for Patent Subject Matter Eligibility ("Guidelines") support Applicants' position.

For example, Annex II of the Guidelines states that “[o]nly ‘when a claim containing [an abstract idea] implements or applies that [idea] in a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect,’ does ‘the claim satis[f]y the requirements of § 101.’” (Guidelines, citing *Diamond v. Diehr*, 450 U.S. 175, 192 (1981) (emphasis added)). Further, Applicants note that the Guidelines extensively rely on the Federal Circuit holding in *AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352 (Fed. Cir. 1999). In *AT&T Corp.*, it is stated that a proper inquiry requires “an examination of the contested claims to see if the claimed subject matter as a whole is ... a ‘law of nature’ or an ‘abstract idea,’ or if the ... concept has been reduced to some practical application rendering it ‘useful’.” 172 F.3d at 1357 (emphasis added). Therefore, the claimed invention as a whole should yield a useful, concrete, and tangible result, not merely the last step of a claim as recited by the Examiner. Because each of claims 9 and 11-13 include the limitations of claim 8, Applicants believe each of these claims also includes at least one concrete, useful and tangible result.

Section 112

Claims 1-7 and 14-20 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Applicants respectfully disagree with the rationale underlying the present rejection and thus believes that the rejection is improper. Applicants are unable to find any authority that prohibits the use of the term “if” as used by Applicants in a claim. However, to advance prosecution, claims 1, 14 and 19 have been amended to replace the term “if” with the term “when”. Accordingly, the rejection should be withdrawn. If, however, the rejection is maintained in a subsequent Office action, Applicants

respectfully that the Examiner provide a detailed and specific citation to sufficient authority in the MPEP for this rejection.

Section 102

Claims 1-20 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,659,754, Grove et al. (“Grove”). Grove appears to be directed to a method and apparatus for an improved optimizing compiler for “more accurately and efficiently identifying live variable sets in a portion of a target computer program, so as to more efficiently locate registers in a computer central processing unit” and thereby reduce erroneous variable spills into memory during program execution. (Abstract; Col. 1, ll. 30-35; Col. 6, ll. 29-32). A variable spill occurs when programs employ more variables than the number of available registers and consequently cache memory and/or random access memory is required. (Col. 5, ll. 18-27). More specifically, Grove appears to use a register allocation routine (FIG. 4) for use with a code optimizer (FIG. 3) wherein the register allocation routine constructs an interference graph by determining live variables in basic blocks. (Col. 6, ll. 32-38, 62-67, Col. 7-8). Each basic block represents “a sequence of consecutive statements in which flow of control enters at the beginning of the block and leaves at the end without halt or the possibility of branching except at the end.” (Col. 6, ll. 40-44).

In determining live variables in each basic block, Grove appears to teach a backwards dataflow analysis that is iteratively performed. (Fig. 5, element 96, Fig. 6; Col. 10, ll. 55-57). The iterative process is described in Col. 7, ll. 40-64 wherein after determining which instructions are live at the beginning of a basic block the process then works “from the last instruction in the basic block 133 to the first instruction in the block. (Col. 7, ll. 40-45). “[I]f the instruction is a ‘use’ in a dummy block, the ‘used’ variable (virtual register) is added to the live

set 134.” (Col. 7, ll. 45-47). Similar add or subtract steps are taken if the instruction is a phi-instruction or an “other instruction.” (FIG. 6, Steps 136 and 138; Col. 7, ll. 46-53). The process is iterative in that after the addition or subtraction steps 134-138 of variables to the live list, the process determines if the most recently examined instruction is the first instruction in the basic block (step 140), indicating that the instruction is the last instruction to evaluate for the basic block. If the instruction is not the first instruction, the immediately previous instruction appears to be the next instruction evaluated according to steps 134-138. (See generally, Col. 7, ll. 44-45; Fig. 6, step 143). In other words, the instructions are ordered in the block and the reverse order from last to first appears to be blindly followed during the examination. Thereafter, the “live set is checked to see if it changed from the start of the processing of this block 146 and if so 148 the global change flag is set to TRUE 150 and control goes to block 154. If the live set did not change 152 a determination is made as to whether there are nay more basic blocks to process 154 and if so 156 the process gets another block 160 and the process for this block is repeated beginning at block 132.” (Col. 7, ll. 55-62).

Applicants note that while Grove appears to use an iterative process to identify live variables in the manner described above, Grove does not contemplate instructions that have multiple components, a previous link or a write mask. At best, Grove appears to teach an instruction that is only capable of producing a single output and further appears to teach a process that sequentially walks backwards over a sequence of command/instructions in a basic block without regard to the structure of an instruction. Additionally, because Grove appears to only add or subtract variables to the live list or set, the reference appears to be silent as to any reference to a deletion of at least one second instruction from the machine code when no components of the at least one second instruction are required. At best, the reference appears to

merely create a more accurate list of “live” variables for use in avoiding spill over (e.g., when the number of variable that must be manipulated during the execution of the program exceeds the number of registers in the CPU). (Col. 12, ll. 26-33).

Independent Claims

Claim 1 requires, among other things:

... examining a first instruction ... [that] includes a previous link and a write mask;
examining at least one second instruction ... [that] includes a previous link and a write mask;
determining if any components within a particular field of the at least one second instruction are required;
when no components of the at least one second instruction are required, deleting the at least one second instruction from the machine code; (Emphasis added).

Addressing the first two limitations (i.e., the examining limitations) reproduced above, the current Office action cites Fig. 6, elements 133, 142, 143, lines 11-12, and column 7, lines 44-47 of Grove with respect to the previous link aspect of the limitations and Fig. 6, element 134, column 7, lines 40-47 and column 16, lines 4-6 with respect to the write mask aspect of the limitations. (Office action, p. 6).

Addressing the previous link portion of the limitations, Applicants respectfully disagree with the Office action. As stated above, Grove does not appear to teach the use of instructions that use a previous link. Instead, Grove appears to sequentially follow the order of instructions in a basic block (in reverse order, from last to first) when examining the instructions. In fact, Applicants note that the very citations used by the Office action to allegedly anticipate Applicants’ claim support Applicants’ position. For example, Fig. 6, element 133 requires the process to start at the last instruction in a basic block. (Col. 7, ll. 39-41). After adding or subtracting a register from a live set or list in steps 134-138, the method continues with step 140 where it is determined whether the current instruction is the first instruction in the block. “If the

latest instruction just processed is the first instruction in the block 144 this means that the block is completed.” (Col. 7, ll. 53-55). If the instruction just processed is not the first instruction in the block, step or element 142, the process becomes iterative in that the previous instruction is obtained, step or element 143. By taking the previous instruction, the process “work[s] from the last instruction in the basic block 133 to the first instruction in the block.” (Col. 7, ll. 44-45). Because the process appears to merely walk backwards sequentially over the block without the use of use of instructions that include a previous link, the rejection is improper.

Addressing the write mask portion of the limitations, Applicants note that none of the cited portions of Grove appear to be related to a write mask. Fig. 6, element 134, for example, is an addition step as discussed above. More specifically, during the iterative process, Fig. 6, element 134 requires that if the instruction is a use in a dummy block the used virtual register/variable is added to the live set. (Col. 7, ll. 44-47). Column 7, lines 40-47 discuss the iterative examination process also discussed above and appears silent as to instructions having a write mask. Lastly, column 16, lines 4-6 states: “The method of claim 19 wherein said phi function is added to said control flow graph where multiple definitions of said variable reach a use of that variable.” This claim of Grove appears to be equivalent to step 124 of Fig. 6 where, in finding variables in each basic block’s live set, the process includes adding dummy blocks with uses of phi-function arguments to the control flow graph (i.e., the CFG). Applicants note that adding a phi function to a control flow graph where multiple definitions of said variable reach a use of that variable is not related to an instruction including a write mask. For these reasons alone, the rejection is improper.

Addressing the third limitation, the Office action cites Fig. 3 and column 4, line 66 through column 5, line 10 as allegedly teaching “determining if any components within a

particular field of the at least one second instruction are required.” Applicants disagree and note that none of the instructions used or described by Grove appear to have multiple components as required by the plural use of the term “components” in the claim. As discussed above, the instructions used by Grove appear to have a single output. Accordingly, for this reason, the rejection appears to be improper. As to the specific citations provided by the Office action, Applicants note that Fig. 3 of Grove appears to be a flow chart for a large-scale organization of the back end of an optimizer compiler. The steps include the construction of a control flow graph, various optimizations, instruction scheduling or software pipelining, register allocation, writing an object file for procedure, and dealing with more procedures, if any. (Fig 3, elements 42-62). Column 4, line 66 – column 5, line 10 restates the steps of Fig. 3 in long form. Absent from Fig. 3 and the cited portion to columns 4-5 is any teaching or suggestion of “determining if any components within a particular field of the at least one second instruction are required.” For the same reasons, no teaching or suggestion is found that anticipates this limitation. For this reason, claim 1 is also believed to be allowable.

Finally, as to the last limitation reprinted above that requires deleting the at least one second instruction from the machine code when no components of the at least one second instruction are required, Applicants respectfully submit that because the third limitation is not taught, this limitation is also not taught by Grove. Addressing, however, the Office action’s citation to Fig. 3 and column 4, line 66 -- column 5, line 10 (Office action, p. 4), Applicants note that this is the same citation used to reject the third limitation discussed above. Similarly, Fig. 3, and column 4, line 66 – column 5, line 10 are utterly void of any deletion of any instructions from machine code. Consequently, the rejection is improper and must be withdrawn.

Claims 8, 14, and 19 each contain one or more of the same or similar limitations as presented above with respect to claim 1. Accordingly, for at least these reasons, claims 8, 14 and 19 are also believed to be in proper condition for allowance.

Dependent Claims

Claims 2-7, 9, 11-13, 15-16, 18, and 20-24 each depend upon an allowable base claim and are also believed to add additional novel and non-obvious, patentable subject matter. For at least the reasons stated above, each of the aforementioned dependent claims are also believed to be allowable over the cited publication.

Accordingly, Applicants respectfully submit that the claims are now in condition for allowance and that a timely Notice of Allowance be issued in this case. The Examiner is invited to contact the below-listed attorney if the Examiner believes that a telephone conference will advance the prosecution of this application.

Respectfully submitted,

Date: July 9, 2007

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